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# Emotional reactivity and regulation in preschool-age children who stutter

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## 1. Introduction

The contribution of emotion to the onset, maintenance and exacerbation of developmental stuttering has long been discussed (e.g., Glauber, 1958; Johnson, 1959; Sheehan, 1953). Alongside such discussion, numerous empirical studies of the relation of emotional processes to stuttering have been reported, with most of these studies involving adults who stutter (e.g., Baumgartner & Brutten, 1983; Caruso, Chodzko-Zajko, Bidinger & Sommers, 1994; Dietrich & Roaman, 2001; Weber & Smith, 1990). Given adults' relatively lengthy experience with and potential learned reactions to stuttering, it is challenging to determine the nature of the association between adults' emotion and stuttering (e.g., does experience with stuttering increase emotional response?) (e.g., Kefalianos et al., 2012). Recently, however, more attention has been paid to the relation between emotion and stuttering in young children who stutter (e.g., Anderson, Pellowski, Conture & Kelly, 2003; Arnold, Conture, Key & Walden, 2011; Choi, Conture, Walden, Lambert, & Tumanova, in press; Conture & Walden, 2012; Eggers, De Nil, & Van den Bergh, 2010, 2013; Johnson, Walden, Conture, & Karrass, 2010; Walden et al., 2012). Increased attention to children, particularly those of preschool-age, is important because stuttering typically begins in early childhood, prior to extensive experience with stuttering and possible development of learned, perhaps well-established, reactions to the disorder.

Some empirical studies of emotions and stuttering (e.g., Anderson, Pellowski, Conture, & Kelly, 2003; Lewis & Goldberg, 1997) have focused on relatively stable/trait-like/dispositional (temperament) variables of emotional development. In contrast, others (e.g., Karrass et al., 2006; Walden et al., 2012) have accessed more variable/state-like/situational (emotional reactivity, emotion regulation) components of emotional functioning. One such trait-like construct – *temperament* - encompasses a group of related traits (e.g., Zentner & Bates, 2008). Temperament, according to Rothbart and Bates (1998), can be described as constitutionally, biologically-based individual differences in reactivity and regulation that demonstrate consistency across various situations and relative stability over time (for



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general review of temperament see Rothbart, 2011; Zentner & Shiner, 2012; for review of temperament specific to speech-language/stuttering see Conture, Kelly & Walden, 2013; Kefalianos, Onslow, Block, Menzies, & Reilly, 2012). Thus, temperament is one attribute of the child that moderates/mediates the influence of their experiences with their environment (Goldsmith et al., 1987). Several researchers have proposed that temperament consists of different dimensions such as adaptability to new situations or people, activity level, attention span/persistence, inhibitory control, rhythmicity, quality of mood and so forth (e.g., Rothbart, Ahahdi, Hershey, & Fisher, 2001; Thomas & Chess, 1977). Another more state-like or situational construct - *emotional reactivity* - refers to the arousability of behavioral, endocrine, autonomic, and central nervous system responses to changes in the environment that have significance for one's goals and well being. Related to emotional reactivity, is the construct of *emotion regulation*, that has been described as consisting of extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (Thompson, 1994; p. 27).

A regulatory strategy examined in the present study and used by children as young as 3 years of age is *distraction*. "Distraction" or "attention deployment" (e.g., Gross, 2002) refers to the direction/engagement of attention to other aspects of the environment (e.g., object, person, event) instead of fixating on the emotionally taxing elements of the situation (e.g., Bridges & Grolnick, 1994). Attentional processes begin to play a central role in modulating arousal early on in life (e.g., Rothbart & Posner, 1985) and maintain their importance for older infants, toddlers, children and adults (e.g., Grolnick, Bridges, & Connell, 1996).

Another regulatory strategy, self-speech, or private speech (i.e., overt, audible speech that is not addressed to a listener), has been extensively studied as a tool for behavioral self-regulation in the preschool years (e.g., Winsler, de León, Carlton, Wallace, & Willson-Quayle, 2003; Winsler, Manfra, & Diaz, 2007) and only recently has its role in emotion regulation being empirically assessed (e.g., Day & Smith, 2013). Broderick (2001) reported that preschool-age children who were rated as well-regulated emotionally by their parents and teachers used more private speech during three different kinds of activities (i.e., free play, art activity, puzzle construction) than their peers who were characterized as poor emotion regulators.

In what follows we will provide a brief review of (a) empirical studies of CWS and CWNS relative to underlying emotional processes/vulnerabilities, (b) studies that have examined the association these emotional processes have to changes in children's stuttering, and finally (c) the purpose and main research questions of the present study.

## 1.1. Studies of emotional processes/vulnerabilites

Many of the existing studies that have examined possible differences in emotional processes between CWS and CWNS have used parent-report questionnaires (e.g., *Behavioral Style Questionnaire [BSQ]*; McDevitt & Carey, 1978; *Dutch version of Child Behavior Questionnaire [CBQ-D]*; Van den Bergh & Ackx, 2003). Results indicate that young CWS, when compared to CWNS, are rated (a) significantly higher on activity level (e.g., Anderson et al., 2003; Embrechts, Ebben, Franke, & van de Poel, 2000; Eggers et al., 2010), (b) more sensitive, anxious, fearful, introverted, withdrawn (e.g., Fowlie & Cooper, 1978; cf. Embrechts et al., 2000), (c) more emotionally reactive (e.g., Karrass et al., 2006), and (d) more negative in quality of mood (Eggers et al., 2010; Wakaba, 1998; cf. Lewis & Goldberg, 1997). Furthermore, several studies have reported differences in attentional processes between young CWS and CWNS. CWS when compared to CWNS are reported to be (a) less adaptable to change (Anderson et al., 2003; Howell et al., 2004; Wakaba, 1998; cf. Lewis & Goldberg, 1997; Williams, 2004), (b) more impulsive and less adept at attentional focusing, attentional shifting, inhibitory control, and perceptual sensitivity (e.g., Eggers et al., 2010; Embrechts et al., 2000; Felsenfeld, van Beijsterveldt, & Boomsma, 2010), and (c) less able to flexibly control their attention and shift attention when required to do so (e.g., Karrass et al., 2006). In general, results from these caregiver-rating studies suggest that CWS differ from CWNS in some emotion-related dimensions.

Other empirical studies of between-group differences in young children's emotional processes have employed psychophysiological methodologies. Arnold et al. (2011) used electroencephalographic (EEG) indices of emotional reactivity and regulation (i.e., frontal alpha asymmetry, for further review of this method, see Coan & Allen, 2004) in preschool-age CWS and CWNS during emotionally-arousing background conversations and found no significant between-group differences in psychophysiological/EEG indices.

In contrast, Jones et al. (2013) measured respiratory sinus arrhythmia (RSA), a physiological index of emotional regulation, during a baseline and two emotion-inducing video clips, as well as narrative tasks, and found that young CWS exhibited significantly lower overall RSA than their fluent peers. Furthermore, CWS, unlike their fluent peers, displayed a significant decrease of RSA change from the baseline to the narrative tasks. This latter finding was taken to suggest that during talking, CWS are less apt to engage the "social communication system" (e.g., Porges, 2007) than their normally fluent peers, perhaps because they perceive communication as a challenge.

Employing another psychophysiological method, Ortega and Ambrose (2011) assessed school-age CWS' emotional reactivity to daily stressors by measuring two stress biomarkers, salivary cortisol and alpha-amylase (for a general review of stress biomarkers, see Dickerson & Kemeny, 2004). Ortega and Ambrose reported that CWS' levels of cortisol and alpha-amylase were significantly lower than published norms. In contrast, van der Merwe, Robb, Lewis, and Ormond (2011) compared cortisol levels in seven preschool-age CWS and seven gender- and age-matched CWNS and found no statistically significant talker-group difference.

Finally, the association of emotional processes and childhood stuttering has been studied by means of behavioral observation in a laboratory setting. Schwenk, Conture, and Walden (2007) investigated differences between preschool-age CWS and CWNS in attention focusing and reaction to irrelevant background stimuli (i.e., audible camera movement) in a laboratory setting. These authors reported that CWS, when compared to CWNS, were significantly more reactive to these environmental stimuli and less likely to quickly habituate to them. Subsequently, Johnson and colleagues (2010) used the *disappointing gift* procedure (e.g., Cole, Zahn-Waxler, & Smith, 1994) with preschool-age CWS and CWNS. This procedure involved participants receiving a desirable gift prior to a free-play conversation and a disappointing gift before a similar conversation. Nonverbal expressive behaviors (positive, negative) during receipt of each gift, as well as speech disfluencies following each gift, were coded. Johnson et al. reported that while receiving the undesirable gift, CWS exhibited more negative emotional expressions than CWNS but during the receipt of the desirable gift there was no significant talker group difference in display of positive emotion. Finally, Choi et al. (in press) studied the role of behavioral inhibition in childhood stuttering and found that, based on behavioral observation in a laboratory setting, preschool-age CWS were more likely to be behaviorally inhibited than their fluent peers, and that more behaviorally inhibited CWS exhibited more stuttered disfluencies than less behaviorally inhibited CWS.

In a recent study, Eggers, De Nil, and Van den Bergh (2012) used a computerized attention test (Fan, McCandliss, Sommer, Raz, & Posner, 2002) to assess underlying attentional networks/subsystems (i.e., orienting, alerting, executive control) in young CWS and CWNS. Results from this study appear to support the notion that CWS's orienting network, the system that is responsible for selectively allocating attention to different sources of input, is less efficient than that of CWNS. Similarly, using a Go/NoGo task, Eggers, De Nil, and Van den Bergh (2013) found that CWS are lower in inhibitory control than their fluent peers. Johnson, Conture, and Walden (2012) compared the attentional abilities (i.e., attentional shifting and focusing) of young CWS and CWNS. They employed an age-appropriate modification of the Posner Cueing Task (Posner & Cohen, 1984; Perez-Edgar, K., & Fox, N. A. (2005) in an emotionally neutral (traditional) and an emotionally arousing condition (affect) but found no significant talker-group differences.

### 1.2. Relation between Emotional Processes and Speech Disfluencies

Although talker-group differences in emotion and regulatory processes appear to support the notion that emotion is associated with childhood stuttering, they do not specifically link these differences in emotion to changes in actual instances of stuttering. To the present authors' knowledge, very few studies (Arnold et al., 2011; Johnson et al., 2010; Walden et al., 2012) have experimentally examined the relation between emotional processes (emotional reactivity, emotional regulation) and instances of stuttered (SD) and nonstuttered disfluencies (NSD) in preschool-age children. Specifically, in two of them (Arnold et al., 2011; Walden et al., 2012) emotion (i.e., negative and positive nonverbal expressions) and emotion regulatory behaviors (i.e., self-stimulation, distraction) as well as SDs and NSDs, were coded while preschool-age CWS and CWNS produced narratives after being exposed to three different emotion-eliciting overheard conversations (happy, angry, neutral). Findings of both studies indicated that CWS who used regulatory strategies less frequently and for shorter durations were more apt to exhibit increased disfluencies. No such relation was found for CWNS. Also, Walden et al. reported that only for CWS was co-occurrence of greater negative emotionality and more frequent regulatory behaviors associated with less stuttering. Finally, Johnson et al. (2010), using the *disappointing gift* procedure (e.g., Cole, Zahn-Waxler, & Smith, 1994) described above, reported that CWS were more disfluent after receiving a desirable than a disappointing gift, suggesting that emotions may contribute to childhood stuttering even in situations involving positive emotion. In essence, early research in this area suggests that changes in emotional processes appear to be related to changes in preschool-age CWS' stuttering.

### 1.3. The Present Study

Given the inconclusive nature of the evidence described above and the relative paucity of published experimental studies in preschool-age children who stutter, more research is needed to clarify the role emotional processes may play in the development and maintenance of childhood stuttering. Furthermore, it is important to note that emotions are influenced by surrounding events and thus their manifestation/expression might differ across everyday and/or experimental situations (i.e., Campos, Mumme, Kermoian, & Campos, 1994). Thus, in order to gain a better understanding of the role of emotions in childhood stuttering, the body of literature should contain studies using different experimental designs and emotion-eliciting conditions.

The purpose of this study was two-fold: (a) to determine whether CWS significantly differ from CWNS in the amount of exhibited emotional reactivity (positive and negative affect) and emotion regulation (self-speech and distraction) behaviors during emotionally-inducing (neutral and frustrating) experimental tasks, and (b) to examine the relation between CWS' and CWNS' emotional behaviors during the experimental tasks and their speech (dis)fluency during subsequent narratives.

The hypotheses, with respect to the aforementioned two main study objectives, are presented immediately below.

1. CWS, when compared to CWNS will exhibit more negative affect, less positive affect, and less emotional regulation in response to emotion-eliciting tasks (i.e., “Apples and Leaves in Transparent Box” [ALTB] neutral task, “Attractive Toy in a Transparent Box” [ATTB] frustrating task).
2. CWNS, when compared to CWS will exhibit a greater increase in negative affect and emotion regulation and greater decrease in positive affect between the neutral (ATLB) and the frustrating (ATTB) task.
3. For both CWS and CWNS higher emotional reactivity and lower emotion regulation exhibited during the neutral and the frustrating tasks will be related to higher frequency of stuttered and non-stuttered disfluencies during the subsequent narrative tasks.
4. CWS, when compared to CWNS, will exhibit more stuttered and non-stuttered disfluencies during the narrative following the frustrating task (ATTB) than during the narrative following the neutral task (ALTB).

## 2. Method

### 2.1. Participants

Participants were 18 preschool-age CWS (14 boys) and 18 preschool-age CWNS (14 boys), all of whom were monolingual, native speakers of American English with no history, based on parental report, of neurological, hearing, developmental, attentional, emotional, academic, and/or intellectual problems. Besides CWS’s stuttering, none of the 36 participants presented with speech and/or language problems and none of the CWS had received formal treatment for stuttering. Participants were between 3;0 [years;months] and 5;11 years of age (CWS: $M = 51.67$, $SD = 9.71$; CWNS, $M = 53.61$, $SD = 9.49$) and there was no statistically significant between-group difference in chronological age, $t(34) = .61$, $p = .55$.

Socioeconomic status (SES) was determined based on parent-report of occupation and education on the Four Factor Index of Social Position (Hollingshead, 1975), which takes into account both maternal and paternal occupation and educational level. There was no significant difference in SES between CWS ($M = 43.67$, $SD = 12.08$) and CWNS ($M = 48.69$, $SD = 10.67$), $t(34) = 1.31$, $p = .20$.

All participants were paid volunteers naïve to the purposes and methods of the study and the majority of them were recruited as part of a longitudinal study investigating the relation between stuttering and emotions conducted by Vanderbilt University’s Developmental Stuttering Project. The present study’s protocol was approved by the Institutional Review Board at Vanderbilt University and for all participants, parents signed informed consent, and their children assented.

### 2.2. Classification and Inclusion Criteria

**2.2.1. Children who stutter (CWS)—**Participants were assigned to the CWS group if they (a) exhibited three or more stuttered disfluencies (sound/syllable repetitions, monosyllabic whole-word repetitions, and sound prolongations) per 100 words of conversational speech (based on a 300-word conversational sample obtained through child-examiner play interaction) (Conture, 2001), and (b) received a total overall score of 11 or above (a severity equivalent of at least “mild” for preschool children) on the *Stuttering*

*Severity Instrument – 4* (SSI-4; Riley, 2009). The mean percent of stuttering frequency (%SDs) and the mean SSI-4 score for the CWS group was 10.33 (*SD* = 5.44) and 19.83 (*SD* = 5.94) respectively.

**2.2.2. Children who do not stutter (CWNS)—**A child was considered a CWNS, if he/she (a) exhibited two or fewer stuttered disfluencies per 100 words of conversational speech (based on a 300-word conversational sample obtained through child-examiner play interaction), and (b) received a total overall score of 8 or below (a severity equivalent of less than "mild" for preschool children) on the SSI-4. The mean percent of stuttering frequency (%SDs) and the mean SSI-4 score for the CWNS group was 0.96 (*SD* = 0.63) and 6.44 (*SD* = 2.53) respectively.

**2.2.3. Speech, Language, and Hearing Criteria—**Prior to experimental testing, all participants were administered the *Peabody Picture Vocabulary Test - Fourth Edition* (PPVT-IVA or B; Dunn & Dunn, 2007), the *Expressive Vocabulary Test - Second Edition* (EVT-2A or B; Williams, 2007), the *Test of Early Language Development - Third Edition* (TELD-3A or B; Hresko, Reid, & Hamill, 1999) and the "Sounds in Words" subtest of the *Goldman–Fristoe Test of Articulation – Second Edition* (GFTA-2; Goldman & Fristoe, 2000) to assess receptive and expressive vocabulary, receptive and expressive language skills, and articulation abilities respectively. Requirements for inclusion in the present study were that children score at or above the 16th percentile rank on all of the standardized tests for their age group. In addition, all participants passed a bilateral pure tone screening at 20dB HL at 1000, 2000, and 4000 Hz.

### 2.3. General overview of procedure

Participants were tested on two separate occasions: a diagnostic and a subsequent experimental session. The initial or diagnostic session included administration of standardized speech-language tests, hearing screening, and elicitation of speech sample through play-based interaction for participant classification and inclusion purposes. During the second or experimental session participants completed a *control* and an *experimental* condition in counterbalanced order.

At the beginning of the experimental session, participants were presented with six gifts (i.e., whistle, bubbles, plastic "winner medal", hair ponytail holder/scrunchy, plastic bracelets, car) and were asked to select the most desirable one ("the really, really cool one"). Then, the experimenter put the selected toy in an 20.3 cm × 20.3 cm × 20.3 cm clear, acrylic, transparent box, locked the box and put it outside of the participants' eyesight.

Subsequent to gift selection, each participant completed a *control* and an *experimental* condition during which he/she was comfortably seated in a child-sized soft armchair. Affixed to the chair was a seat belt that was buckled around the child to reduce the likelihood the child would move outside of the area captured by the video-recording cameras. As shown in Figure 1, during both conditions an approximately 3-min emotion-manipulation task ("Apples and Leaves in Transparent Box," the control condition; "Attractive Toy in a Transparent Box," the experimental condition) was followed by a story preview and a narrative task.

### 2.4. Conditions

**2.4.1. Control Condition—**At the beginning of the *control* condition participants engaged in an approximately 3-minute "Apples and Leaves in Transparent Box" (ALTB) task. As part of this task, participants removed 98 small construction paper apple and leaf cut-outs, attached to a tree cut-out (46.2-cm wide and 40.6-cm tall), and put them in the acrylic locked ballot box through a slit (2.5-cm wide and 10.2-cm in length). Specifically, participants were told, "I need to do something in the next room but I will be back very soon. While I am gone please put the apples and the leaves, one at a time just like that (experimenter demonstrates the task for the participant) in the box." The box and the tree were attached by hook and loop fasteners (Velcro) on a low chair in front of the child and on a plastic box next to the child respectively. While participants were by themselves in the testing room they were audio-visually monitored by the experimenter and their parent(s) through a one-way mirror.

The ALTB task was designed to share similarities with the experimental condition's "Attractive Toy in a Transparent Box" (ATTB) procedure (Goldsmith et al., 1999), which will be described in the next section. Specifically, both tasks involved a transparent box and also required participants to use their hands to manipulate age-appropriate objects. However, the ALTB, contrary to the experimental ATTB task, was not expected to elicit intense and/or frequent frustration-related emotions.

Immediately following the ALTB task, the experimenter returned and previewed with participants a story about a dog and a little girl by using 20 pictures/photos from one of two of Alexandra Day's textless storybooks (i.e., *Carl's Sleepy Afternoon*, or *Carl's Snowy Afternoon*), with storybooks randomly assigned to the control or experimental conditions. Pictures from the story were presented at a constant rate of two pictures (side-by-side) per 2 seconds with PowerPoint slide show on a 23-inch Apple LED cinema display attached to a MacBook. At the beginning of the "story preview" condition, participants were instructed to quietly look at the pictures and think about the story in preparation for the narrative task.

After participants previewed the story, they were encouraged to tell it by looking at the pictures on the screen. To elicit the narrative, the experimenter provided up to three standard prompts (e.g., "Tell me more," "What is happening on this page?" "What else?"), if needed, until the child produced at least two utterances per picture (see, Arnold et al., 2011; Walden et al., 2012).

Throughout the narrative task, participants were updated on their progress regarding completion of the task (e.g., "You only have three more pages left") but were not encouraged or given specific feedback about their performance. The experimenter responded to participants' picture descriptions/narrative with general comments such as "mhm" and "I see."

**2.4.2. Experimental Condition—**For the *experimental* condition, participants completed the "Attractive Toy in a Transparent Box" (ATTB) task from the Laboratory Temperament Assessment Battery (LabTab; Goldsmith et al., 1999). Specifically, the experimenter gave the participants a set of 10 keys, none of which opened the transparent box with the desired gift. The box was attached by hook and loop fasteners to a low chair in front of the child. Participants were instructed to open the transparent box and get the gift by using the keys (i.e., "I need to do something in the other room. I will let you work on opening the box. I don't know which key opens the box so make sure you try each one of them. When you open the box you can take the prize and take it home with you."). After giving directions, the experimenter left the room and participants were left by themselves to try to open the locked box for approximately 3 minutes, while being audio-visually monitored by the experimenter and their parent(s) through a one-way mirror.

At the end of the 3-min period, the experimenter returned to the room, acknowledged that she must have given the child the wrong keys, and told the participant that he or she would open the box and get the prize at the end of the session when he/she would be done with all the games.

### 2.5. Audiovisual Recording

During the experimental sessions, audiovisual recordings were made by two video cameras, one mounted on a 40.64-cm tall tripod directed toward the child's face and one directed diagonally towards the child's body. Pinnacle Studio high definition (HD) editing software was used to combine the two recordings into a single audiovisual record. This resulted in a new mpeg2 file with the two video images (i.e., face and body shot) and the audio multiplexed into a split screen. Based on these split-screen audiovisual files, all dependent variables (e.g., stuttered and non-stuttered disfluencies, negative affect) were measured.

### 2.6. Dependent Variables / Measures

**2.6.1. Emotional Reactivity—**During offline review of the digital video recordings of the control and experimental emotion manipulation tasks (i.e., ALTB and ATTB) emotional reactivity was coded as: (1) positive affect, and (2) negative affect. Indications of *positive* affect included: (a) lip corners pulled up/smile (broad or closed lip), (b) raised cheeks, (c) positive in content and/or tone verbalizations (e.g., "that is fun"), and (d) non-verbal positive vocalizations (e.g., laughing, giggling). Behavioral measures of *negative* affect included: (a) lip corners pulled down and out, (b) furrowed/downturned eyebrows, (c) eyes narrowed/ squinted, (d) wrinkled nose, (e) negative in content and/or tone verbalizations (e.g., "that is so hard"), (f) non-verbal negative vocalizations (e.g., sharp breath exhalation, sighing), and (g) aggressive behaviors (e.g., banging, kicking, throwing) directed towards objects (e.g., transparent box, keys). The above coding scheme was based on a review of several coding schemes for emotional reactivity employed in other empirical studies (i.e., Calkins, 1997; Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996; Cole, Barret, & Zahn-Waxler, 1992; Jahromi, Gulsrud, & Kasari, 2008; Jahromi & Stifter, 2008; Walden et al., 2012).

An event-based continuous strategy for coding observational data was used (e.g., Bakeman & Gottman, 1997). That is, onset and offset times of every codeable behavior during the control and the experimental manipulation tasks were coded for each participant by using PROCODER, a specialized behavior-coding software (Tapp & Walden, 1993). Given that positive and negative emotional reactivity were not mutually exclusive but rather could co-occur at the same time, participants' negative and positive emotional behaviors were coded separately. Thus, "time-budget" information (i.e., proportion of time coded in a particular way) for each of the two emotional reactivity categories was obtained and used as dependent variable in subsequent data analyses.

Time periods during which the participant's face was not visible on the camera were deemed uncodeable and thus were excluded from analyses. There was no significant between-talker group difference in the mean number of uncodeable seconds for neither the ALTB (CWS: $M = 4.19$, $SD = 4.97$; CWNS: $M = 1.6$, $SD = 3.59$; $t(34) = 1.78$, $p = .08$) nor the ATTB tasks (CWS: $M = 3.6$, $SD = 4.48$; CWNS: $M = 2.18$, $SD = 4.07$; $t(34) = .99$, $p = .33$.

For inter-judge measurement reliability a trained secondary rater coded 22% of the total data corpus, that is, eight randomly selected ALTB segments (4 from CWS, 4 from CWNS) and eight randomly selected ATTB segments (4 from CWS, 4 from CWNS). Cohen's (1960) Kappa for *negative* and *positive affect* was 0.77 and 0.75 respectively, indicating good reliability.

**2.6.2. Emotion Regulation—**Emotional regulation was coded as: (1) self-speech, and (2) distraction. *Self-speech* refers to verbalizations produced by the child (e.g., "I don't know which key it is," "This is the most boring thing I have ever done," "I need help") in the absence of the experimenter. Self-speech, or private speech (i.e., overt, audible speech that is not addressed to a listener), has been extensively studied as a tool for behavioral self-regulation in the preschool years (e.g., Winsler, de León, Carlton, Wallace, & Willson-Quayle, 2003; Winsler, Manfra, & Diaz, 2007). Other studies have considered the use of language, in the form of self-speech, in emotion regulation (i.e., Broderick, 2001, Day & Smith, 2013). For this study, self-speech is used as an index of emotion regulation.

*Distraction* refers to the diversion of attention to something other than the ALTB and the ATTB tasks and includes but is not limited to behaviors such as: (1) looking at the keys but not attempting to open the box, (2) looking at different objects in the room while not attempting to open the locked box or put the apples and leaves in the transparent box during the ATTB and the ALTB tasks, (3) looking at the prize in the box but not attempting to open the box. Self-speech and distraction have been coded in other similar empirical studies (i.e., Calkins & Johnson, 1998; Day & Smith, 2013; Jahromi & Stifter, 2008).

As described above for the coding of emotional reactivity behaviors, the onset and offset of each occurrence of *self-speech* and *distraction* observed during the ATTB and the ALTB tasks was coded and duration was recorded for each participant.

For inter-judge measurement reliability the same trained secondary rater coded 22% of the total data corpus, that is, eight randomly selected ALTB segments (4 from CWS, 4 from CWNS) and eight randomly selected ATTB segments (4 from CWS, 4 from CWNS). Cohen's (1960) Kappa for *self-speech* and *distraction* was 0.9 and 0.95 respectively, indicating excellent reliability.

**2.6.3. Speech Disfluency—**Computer-based transcriptions of the narratives (SALT, Systematic Analysis of Language Transcripts; Miller & Iglesias, 2008) were produced based on participants' audiovisual recordings. Abandoned and interrupted utterances, as well as utterances containing singing and recitation were excluded from analyses. The final analysis data set for CWS and CWNS consisted of 12,153 and 11,569 words, respectively. There was no significant between-talker group difference in the mean number of words produced (CWNS: $M = 675.17$, $SD = 184.51$; CWS: $M = 642.72$, $SD = 189.72$; $t(34) = -.52$, $p = .61$).

Stuttered disfluencies (SDs; sound/syllable repetitions, monosyllabic word repetitions, and sound prolongations) and non-stuttered disfluencies (NSDs; multisyllabic word repetitions, phrase repetitions, interjections, and revisions) were coded within each transcribed narrative.

Interjudge measurement reliability for speech disfluencies was calculated based on the narrative speech samples of 4 randomly selected CWS and 4 randomly selected CWNS (representing 22% of the total data corpus). The first and second coders were certified speech-language pathologists trained in coding speech disfluencies. Coefficient alpha (Cronbach, 1951) assessed reliability of the two coders on the percentage of SDs (i.e., total number of SDs per total number of words produced *100), and the percentage of NSDs (i.e., total number of NSDs per total number of words produced *100). Coefficient alphas for those two variables (%SDs, %NSDs) were .94 and .98 respectively, indicating excellent reliability.

### 2.7. Data Analysis

A series of separate generalized linear mixed models (GLMM) were constructed to test the study's hypotheses as presented in the Introduction.

To test the first two hypotheses, four separate models were constructed to examine the four dependent measures (i.e., percentage of negative affect, percentage of positive affect, percentage of self-speech, percentage of distraction). Given non-normality of all four outcomes (*positive emotion*: skewness = 1.8, kurtosis = 2.52; *negative emotion*: skewness =

1.67, kurtosis = 2.18; *self-speech*, skewness = 2.61, kurtosis = 7.5; and *distraction*, skewness = 2.01, kurtosis = 3.74), the GLMM analyses (Breslow & Clayton, 1993) used a log link function to fit them to a gamma distribution. All four models included talker group (CWS, CWNS) and condition (control, experimental) as fixed factors, and age and gender as covariates. Also, the interaction of talker group and condition, as well as a random effect intercept were included in all models. The Satterthwaite approximation, which does not assume equal variances, was used to calculate degrees of freedom for main effects and talker group x condition interactions (Satterthwaite, 1946).

To test the third hypothesis, for each talker group two separate models were constructed to examine percentage of stuttered disfluencies (%SDs), and percentage of non-stuttered disfluencies (%NSDs) respectively. Both statistical models included percentage of negative affect, percentage of positive affect, percentage of self-speech, and percentage of distraction as fixed factors and condition (control, experimental), and age as covariates. The GLMM analyses used a log link function to fit %SDs" and %NSDs" to a gamma and a normal distribution, respectively.

To test the fourth hypothesis, two separate GLMM analyses were conducted to examine %SDs and %NSDs, respectively. Both models included talker group (CWS, CWNS), condition (control, experimental), and interaction of talker group and condition as fixed factors, and age as a covariate. The Satterthwaite approximation was used to calculate degrees of freedom.

Finally, it should be noted that when certain inferential statistical models (e.g., GLMM) are used, the estimated marginal means (*EMM*) and standard error values (*SE*) rather than the slightly different "raw," observed, or descriptive means (*M*) and standard deviation (*SD*) are reported. Thus, Table 1 provides the estimated marginal means (*EMM*) and standard errors (*SE*) for all the dependent measures (i.e., negative affect, positive affect, self-speech, distraction, percentage of stuttered disfluencies, percentage of non-stuttered disfluencies) for CWS and CWNS for the control and the experimental conditions.

# 3. Results

## 3.1. Between-group Differences

**3.1.1. Emotional Reactivity—**Results indicated that CWS displayed significantly more *negative* affect than CWNS, $F(1,23) = 18.14$, $p < 0.01$. Furthermore, this between-group difference in negative affect was significant for both the control, $F(1,57) = 6.72$, $p < 0.05$, and the experimental conditions, $F(1,38) = 13.22$, $p < 0.01$. However, there was no statistically significant talker group x condition interaction, $F(1,16) = 0.2$, $p = .66$. Both CWS and CWNS exhibited significantly more negative affect during the experimental than the control condition ($F(1,20) = 38.56$, $p < .01$) and this difference was not differential for the two talker groups. That is, CWS and CWNS responded similarly to the experimental manipulation.

In terms of *positive* affect, there was no between-group difference, $F(1,26) = 0.08$, $p = .78$. Similarly, there was no significant talker group x condition interaction, $F(1,21) = 0.25$, $p = .62$. Neither CWS nor CWNS exhibited significantly less positive affect during the experimental than the control condition [*CWS*: $F(1,43) = 1.21$; $p = .28$; *CWNS*: $F(1,15) = 0.07$; $p = .79$].

**3.1.2. Emotion Regulation—**Findings indicated that CWS exhibited a significantly greater amount of *self-speech* than CWNS, $F(1,22) = 6.56$, $p = .02$. This between-group difference in self-speech was significant for the control, $F(1,50) = 7.64$, $p < 0.01$, but not for

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the experimental condition, $F(1,40) = .21$, $p = .65$. Also, there was a significant talker group x condition interaction, $F(1,24) = 4.82$; $p = .04$, in that only CWNS exhibited a significant increase in the amount of self-speech from the control to the experimental condition, $F(1,42) =10.08$; $p < 0.01$. The increase in self-speech for the CWS group from the control to the experimental condition was not statistically significant, $F(1,25) = 3.44$; $p = .08$.

In terms of *distraction*, there was no between-group difference, $F(1,19) = 1.5$, $p = .24$. Similarly, there was no significant talker group × condition interaction, $F(1,22) = 0.27$, $p = .60$. Neither CWS nor CWNS exhibited significantly more distraction behaviors during the experimental than the control condition [*CWS*: $F(1,59) = 2.37$; $p = .28$; *CWNS*: $F(1,10) = 0.57$; $p = .47$].

**3.1.3. Ancillary (Qualitative) Assessment of Different Types of Self-Speech—**In an attempt to better understand the use of self-speech by CWS and CWNS, only during the frustrating task (ATTB), four different types of self-speech (nonfacilitative task-relevant, facilitative task relevant, irrelevant facilitative, and irrelevant nonfacilitative) were coded and their duration was recorded for each talker group separately. "Nonfacilitative task-relevant" utterances related to the task but inhibited efforts (e.g., "I cannot do this"), "facilitative task-relevant" utterances were related to the task but did not stop efforts (e.g., "I will try the other key"), "irrelevant facilitative" utterances were unrelated to the task but did not inhibit efforts (e.g., "I like cheese"), and "irrelevant nonfacilitative" utterances were unrelated to the task and were followed by cessation of efforts to open the box.

The percentage of each type of self-speech (e.g., percentage of nonfacilitative task-relevant = duration of nonfaciliative task-relevant / total duration of self-speech * 100) was calculated for the two talker groups. Given the study's somewhat restricted sample size ($N = 36$) and the relatively infrequent use of self-speech the percentage of each type of self-speech could be compared only informally – not statistically - between CWS and CWNS. Based on a qualitative/informal inspection of the data it seems that only for one type of self-speech, the "nonfacilitative task-relevant," CWS showed a relatively higher percentage (CWS: 29.61%, CWNS: 24.07%). However, this qualitative finding needs to be viewed with extreme caution because in the absence of quantitative statistical analysis conclusions based on this finding may be erroneous. If this finding is replicated in future studies employing inferential statistics, it might suggest that even though CWS use more self-speech behaviors than CWNS some of these behaviors might contribute to the increase rather than the decrease of emotional arousal.

**3.1.4. Speech Disfluencies—**Neither CWS [$F(1,67) = .02$; $p = .89$] nor CWNS [$F(1,67) = .12$; $p = .73$] exhibited a greater percentage of stuttered disfluencies in the experimental compared to the control condition. Similarly, neither a main effect of condition [$F(1,61) = .04$, $p = .85$], nor an interaction effect of condition by talker group [$F(1,61) = .75$, $p = .39$] was found for the percentage of non-stuttered disfluencies.

### 3.2. Relation between Emotional Processes and Disfluencies

**3.2.1. Children Who Stutter—**For CWS proclivity to *self-speech* while engaged in the control and the experimental tasks was associated with a greater percentage of stuttered disfluencies during the narrative tasks, est. $\beta = .04$, $p = .05$. However, greater duration of distraction behaviors during the tasks was negatively related to the percentage of stuttered disfluencies produced during the subsequent narratives, est. $\beta = -.04$, $p = .03$. That is, the greater amount of time CWS participants diverted their attention from the tasks, the less they stuttered during the narratives. Neither positive (est. $\beta = -.03$, $p = .09$) nor negative affect (est. $\beta = -.01$, $p = .82$) was associated with stuttering.

Finally, for CWS, neither emotional reactivity (i.e., positive affect, negative affect) nor emotion regulation behaviors (i.e., self-speech, off-task) were associated with percentage of non-stuttered disfluencies (*negative affect*, est. β = −.004, *p* = .91; *positive affect*, est. β = .02, *p* = .38; *self-speech*, est. β = −.01, *p* = .75; *distraction*, est. β = −.04, *p* = .20).

**3.2.2. Children Who Do Not Stutter—**For CWNS, only negative affect was associated with percentage of non-stuttered disfluencies (est. β = .06, *p* = .006) produced during the subsequent narratives. That is, CWNS's proclivity to negative emotional reaction during the tasks was associated with a greater percentage of non-stuttered disfluencies exhibited during the narrative tasks. However, negative affect was not associated with percentage of stuttered disfluencies (est. β = .17, *p* = .09).

CWNS's other emotional reactivity and emotion regulation behaviors were not associated with either the percentage of stuttered (*positive affect*, est. β = −.07, *p* = .46; *self-speech*, est. β = − .13, *p* = .31; *distraction*, est. β = .16, *p* = .17) or the percentage of non-stuttered disfluencies (*positive affect*, est. β = .001, *p* = .95; *self-speech*, est. β = −.01, *p* = .81; *distraction*, est. β = −.02, *p* = .50).

## 4. Discussion

### 4.1. General Discussion

The overarching goal of this study was to study emotional reactivity and emotion regulation processes for preschool-age CWS and CWNS during emotionally-inducing (neutral and frustrating) experimental tasks and to determine whether such processes are associated with speech disfluencies in subsequent narratives.

As initially hypothesized and consistent with previous research CWS were shown to be more emotionally reactive than their fluent peers, as evidenced by increased levels of exhibited negative affect in both the neutral and the frustrating tasks. Also, in terms of emotion regulation, CWS exhibited more self-speech than CWNS during the emotionally neutral task. Although this finding seems to contradict initial predictions and prior research that shows that CWS exhibit less, rather than more, self-regulatory behaviors than CWNS, it is unclear whether the type of self-speech used by CWS was regulatory or not in nature.

In terms of the relation of emotional processes exhibited during the tasks and speech disfluencies produced during the subsequent narratives, it was found that for CWS greater duration of distraction was associated with lower percentage of *stuttered* disfluencies and greater amount of self-speech was associated with higher percentage of *stuttered* disfluencies. However, there was no relation for CWS between emotional processes (i.e., emotional reactivity, emotion regulation) and *non-stuttered* disfluencies. Implications of the study's findings are discussed in the sections to follow.

### 4.2. Emotional Reactivity: Between-group Differences

The finding of increased negative affect in CWS is consistent with previous research that CWS, when compared to CWNS, are more reactive (e.g., Karrass et al., 2006; Schwenk et al., 2007), negative in quality of mood (e.g., Eggers et al., 2010; Wakaba, 1998), and exhibit more negative emotional expressions when receiving a disappointing gift (Johnson et al., 2010). Furthermore, this finding is consistent with the suggestion that a temperament that is sensitive, reactive, easily aroused, and relatively intolerant of frustration contributes to the onset and development of stuttering (e.g., Guitar, 2006; Hill, 1999; Starkweather, 2002) and appears consistent with recent findings that when compared to their CWNS peers, there are more CWS with extremely high behavioral inhibition (Choi et al., in press).

However, CWS and CWNS did not appreciably differ in terms of displayed positive emotion. This finding is in agreement with parent questionnaire-based results of no significant talker-group difference in terms of positive affect (Eggers et al., 2010) and consistent with Johnson et al.'s (2010) report that while receiving a desirable gift CWS did not exhibit more positive emotional expressions than CWNS.

### 4.3. Emotion Regulation: Between-group Differences

The finding regarding between-group difference in self-speech did not support the initial hypothesis that CWS would produce less self-speech than their normally fluent peers. This prediction was based on previous research findings describing CWS as less able to regulate their emotions than CWNS (Karrass et al., 2006). However, it should be noted that, unlike the present study, Karrass et al (2006) investigated parental reports of CWS's emotion regulatory *effectiveness* (e.g., high regulation leading to lower reactivity), rather than the actual *occurrence* of regulatory attempts.

Nevertheless, closer scrutiny of the present findings, as well as consideration of the dynamic interplay between emotional reactivity and emotion regulation seems to confirm rather than oppose Karrass et al.'s finding that CWS are poorer emotion regulators than CWNS. In other words, CWS might have engaged in more self-speech behaviors than their fluent peers but, contrary to expectations, decreased levels of emotional reactivity did not accompany these regulatory attempts. This may suggest that even though preschool-age CWS used more regulatory behaviors, their regulatory efforts might not have been very effective in modulating their emotions.

Self-speech has been shown to play an important role in planning, monitoring, guiding, and self-motivating oneself during different activities. Thus, it is not surprising that an increase in task complexity and difficulty yields an increase in the frequency of self-talk (e.g., Duncan & Pratt, 1997; Patrick & Abravanel, 2000). However, in the present study, only CWNS adjusted the use of self-speech to task demands by exhibiting significantly more self-speech during the experimental than the control task. The finding that CWS demonstrated high levels of self-speech during both control and experimental tasks could be taken to suggest that, unlike their fluent peers, CWS perceived both tasks to be challenging, an interpretation which would be indirectly supported by CWS's concurrent increased negative affect.

With regard to the role of self-speech in emotion regulation this finding could be taken to suggest that CWS are better-regulated than their fluent peers. However, as aforementioned, one needs to consider emotion regulation in the context of emotional reactivity. That is, if CWS were indeed better emotion regulators than CWNS one would expect, contrary to the present study's findings, those regulatory behaviors to be accompanied by decreased levels of emotional reactivity compared to those of their fluent peers. So, the possibility exists, that mere increases in self-speech were less than effective at regulating emotion in CWS.

Apropos to the above possibility, Day and Smith (2013) examined the usage of different types of self-speech during the "attractive toy in the transparent box paradigm," and found that only facilitative task-relevant utterances (i.e., utterances that were related to the task but did not stop efforts to open the box) were correlated with decreased negative emotion, whereas high levels of nonfacilitative task-relevant utterances (i.e., utterances that were related to the task but inhibited or stopped efforts to open the box) were related to high levels of negative emotion. Thus, one could posit that even though CWS exhibited a greater quantity of self-speech behaviors than CWNS, these behaviors might have been qualitatively different. However, as stated earlier, given the study's somewhat restricted sample size ($N$ = 36) and the relatively infrequent use of self-speech, it was not feasible to employ inferential statistical methodology to assess between- group differences in the duration and/or frequency of various types of self-speech (e.g., facilitative task-relevant utterances, nonfacilitative task-relevant utterances).

### 4.4. Relation of Emotion Regulation and Stuttered Disfluencies for Children Who Stutter

Contrary to the authors' initial hypothesis, the more CWS engaged in self-speech during the neutral and the frustrating tasks, the more they stuttered during the narrative tasks. This finding suggests the possibility that the association between self-speech and speech-language planning and production processes is mediated by emotional reactivity in one of the following alternative ways. First, it could be speculated that CWS who use self-speech effectively to regulate their emotions during non-communicative tasks, would have difficulty doing the same (i.e., modulating their emotional reactions) during communication given the perceived or real limited opportunities for self-speech while talking to a listener. Alternatively, for other CWS, heightened emotional arousal might be due to the fact, as suggested by Day and Smith (2013), that some types of self-speech are associated with increased rather than decreased negative emotions. Perhaps, therefore, for some CWS self-speech heightens rather than lowers their emotionality. Regardless of whether heightened emotional arousal is attributed to the presence rather the absence of self-speech it is possible that in both scenarios, children's emotional arousal may divert limited attentional resources from an already, for some CWS, vulnerable speech-language planning and production system (e.g., Ntourou, Conture, & Lipsey, 2011) and in turn contribute to disruptions in their speech fluency.

In support of the authors' initial hypothesis, CWS who tended to shift their attention away from the neutral and the frustrating tasks were less likely to be disfluent during the subsequent narratives. This finding could be interpreted in at least three different ways. First, even though neither emotional reactivity nor emotion regulation behaviors were assessed during children's story-telling, it could be suggested that during speech, CWS' attention shifting has fluency-inducing effects by modulating heightened emotional responses. This interpretation is consistent with results of previous studies indicating that CWS who use regulatory strategies less frequently and for shorter durations are more apt to exhibit increased disfluencies (Arnold et al., 2011; Walden et al., 2012). Second, it is possible that CWS' attention shifting facilitates their speech fluency not only by modulating emotional reactions but also by diverting undue attention to or monitoring of their ongoing speech planning and production. The latter possibility has been shown to be fluency inducing for some adults who stutter (e.g., Arend, Povel, & Kolk, 1988), maybe for those whose stuttering is partially attributed to a strong to hyperfunctioning of speakers' internal speech-planning and production monitoring system (e.g., Vasić & Wijnen, 2005). Third, one could speculate that for other speakers diverting attention from a non-verbal task allows them to devote greater attentional resources to speech-language planning and production processes and in turn helps them be more fluent.

### 4.5. Relation of Emotional Processes and Non-Stuttered Disfluencies

Present findings indicated that for CWS, neither emotional reactivity nor emotion regulation behaviors were predictive of non-stuttered disfluencies. To the present writer's knowledge this was the first attempt to assess young CWS's emotional processes in relation to their non-stuttered or "other" disfluencies. This finding could be taken to suggest that for CWS non-stuttered, when compared to stuttered, disfluencies are less susceptible to exogenous or environmental stressors. Conversely, present findings indicated that for CWNS increased negative affect was associated with increased percentage of non-stuttered disfluencies. Thus, one could hypothesize that the underlying mechanisms for non-stuttered disfluencies may differ between CWS and CWNS.

# 5. Caveats

## 5.1. Sequence of Tasks

As stated earlier in the methods section, for all participants the "story preview" task separated the emotion manipulation tasks (i.e., ATTB, ALTB) and the narrative tasks. Even though this experimental sequence might have facilitated the story-telling task given that participants previewed the story immediately prior to telling it, it is likely that the temporal gap between emotion manipulation tasks and narrative tasks appreciably dissipated the effect of emotions elicited during the tasks to the speech (dis)fluency, at least to some degree.

## 5.2. Behavioral Measures of Negative Affect and Emotion-Eliciting Tasks

As described in the methods section, some of the nonverbal expressive behaviors coded during the control (i.e., ALTB) and the experimental (i.e., ATTB) tasks included "eyes squinted," "furrowed eyebrows," and "wrinkled nose." Even though, these facial expressions are suggestive of negative affect, they can also accompany physical effort in the form of motoric overflow. Thus, one cannot categorically refute the possibility for the higher demands for physical effort during the ATTB task to have attributed to the finding that participants exhibited more negative affect during the experimental than the control task. Whether this caveat had an effect on the significant between-group difference remains an open empirical question.

## 5.3. Behavioral Coding of Self-Speech

As alluded to earlier, due to the somewhat restricted sample size ($N = 36$) and the relatively infrequent use of self-speech it was not feasible to statistically assess between-group differences in different types of self-speech (e.g., facilitative task-relevant utterances, nonfacilitative task-relevant utterances) in order to elucidate the role of self-speech in speech (dis)fluency. Future investigations in this area would, however, be well served by attempting to code and analyze different "types" of self-speech (i.e., inhibitory vs. facilitative self-speech)

# 6. Conclusion

Present findings - based on using direct observation of behavioral correlates of emotional reactivity and emotion regulation - provide support for the notion that preschool-age CWS are more emotionally reactive than their CWNS peers. This finding is curious, however in light of the fact that CWS exhibit more self-speech regulatory behaviors than CWNS. Bringing together these two findings leads one to the possibility that CWS's regulatory attempts may not be very effective in modulating their emotions. Indeed, for preschool-age CWS, there appears to be a link between emotion regulation strategies and stuttered disfluencies, with self-speech seemingly inhibiting fluency whereas attention shifting, or distraction, seemingly facilitating fluent speech-language production.

These latter findings suggest that the association between emotion regulation and disruption in speech fluency could be influenced by various permutations of attentional processes, relatively unregulated emotional arousal, and/or competing communicative intentions. However, further empirical research is needed to experimentally investigate these possibilities, with results of such research hopefully further elucidating the association between preschool-age CWS's emotional processes and their speech-language planning and production. Overall, however, present findings support the notion that emotional processes are associated with childhood stuttering and may possibly contribute to the difficulties that at least some CWS have establishing normally fluent speech.

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## Biographies

### Katerina Ntourou

Katerina Ntourou, Ph.D, CCC-SLP, is a speech-language pathologist at the Vanderbilt Bill Wilkerson Center. Her main research interests include the way attention and emotional and language variables contribute to childhood stuttering.

**Edward G. Conture**

Edward Conture, Ph.D., CCC-SLP, is a professor at the Department of Hearing and Speech Sciences at Vanderbilt University. Dr. Conture is an ASHA Fellow and has received the Honors of the Association. His main research interests relate to the role of emotional and linguistic variables to the onset and development of childhood stuttering.

**Tedra A. Walden**

Tedra Walden, Ph.D., is a Professor of Psychology at Peabody College at Vanderbilt University and a Senior Fellow at the Institute for Public Policy Studies. Dr. Walden's research focuses on the early socio-emotional development and the role of emotions in childhood stuttering.

## Appendix

1. Results from empirical studies of emotional/attentional processes and childhood stuttering seem to suggest that:

    **a.** Children who stutter compared to children who do not stutter are less emotionally reactive.

    **b.** Certain attentional processes (i.e., attention shifting) are less efficient in children who stutter than children who do not stutter.

    **c.** Emotional processes can solely explain stuttered and non-stuttered disfluencies.

    **d.** Attentional processes do not play a role in childhood stuttering

    **e.** None of the above

    CORRECT ANSWER: **b**.

2. Emotional processes (i.e., emotional reactivity, emotion regulation) in young children who stutter have not been studied with the use of:

    **a.** Parent-report questionnaires

    **b.** Behavioral observation

    **c.** Electroencephalography

    **d.** fMRI (Functional magnetic resonance imaging)

    **e.** Physiological indices such as respiratory sinus arrhythmia (RSA)

    CORRECT ANSWER: **d**.

3. Which of the following is an accurate statement regarding results from this study:

    **a.** Children who stutter exhibited more negative emotion than children who do not stutter only in the experimental condition.

    **b.** Children who stutter exhibited less positive emotion than children who do not stutter in the experimental condition.

    **c.** Children who stutter exhibited more negative emotion than children who do not stutter in both the experimental and the control conditions.

    **d.** Children who stutter exhibited greater percentage of stuttered disfluencies in the experimental compared to the control condition.

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- **e.** For children who stutter greater amount of self-speech during the tasks was associated with lower percentage of stuttered disfluencies during the subsequent narratives.

CORRECT ANSWER: **c**.

**4.** Results from this study seem to support the notion that:

- **a.** Emotional reactivity, rather than emotion regulation, is the most important factor in the onset of childhood stuttering
- **b.** Emotion regulation, rather than emotional reactivity, is the most important factor in the onset of childhood stuttering
- **c.** Children who stutter are more emotionally reactive than children who do not stutter
- **d.** Emotional processes are not associated with childhood stuttering
- **e.** Preschool-age children who stutter and exhibit increased levels of emotional reactivity are more likely to persist than recover from stuttering.

CORRECT ANSWER: **c**.

**5.** Which of the following is an accurate statement?

- **a.** It is difficult to determine the directionality of effect between emotion and stuttering in young children who stutter. That is, whether stuttering causes the creation of emotion (i.e., stuttering → emo on), or whether emo on plays a causal role in the onset and development of stuttering (i.e., emotion → stuttering).
- **b.** All children who stutter are more emotionally reactive than children who do not stutter.
- **c.** Emotional processes impact children's speech disfluency more than linguistic and motoric processes.
- **d.** Parents of children who stutter have been shown to be more emotionally reactive than parents of children who do not stutter.
- **e.** None of the above

CORRECT ANSWER: **a**.

**Educational objectives**

The reader will be able to: (a) communicate the relevance of studying the role of emotion in developmental stuttering close to the onset of stuttering, and (b) describe the main findings of the present study in relation to previous studies that have used different methodologies to investigate the role of emotion in developmental stuttering of young children who stutter.

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## Highlights

- Preschool-age CWS are more emotionally reactive than their normally fluent peers.
- There is a relation between emotional processes and rate of stuttered disfluencies.
- Emotional reactivity and emotion regulation seem to be associated with stuttering.

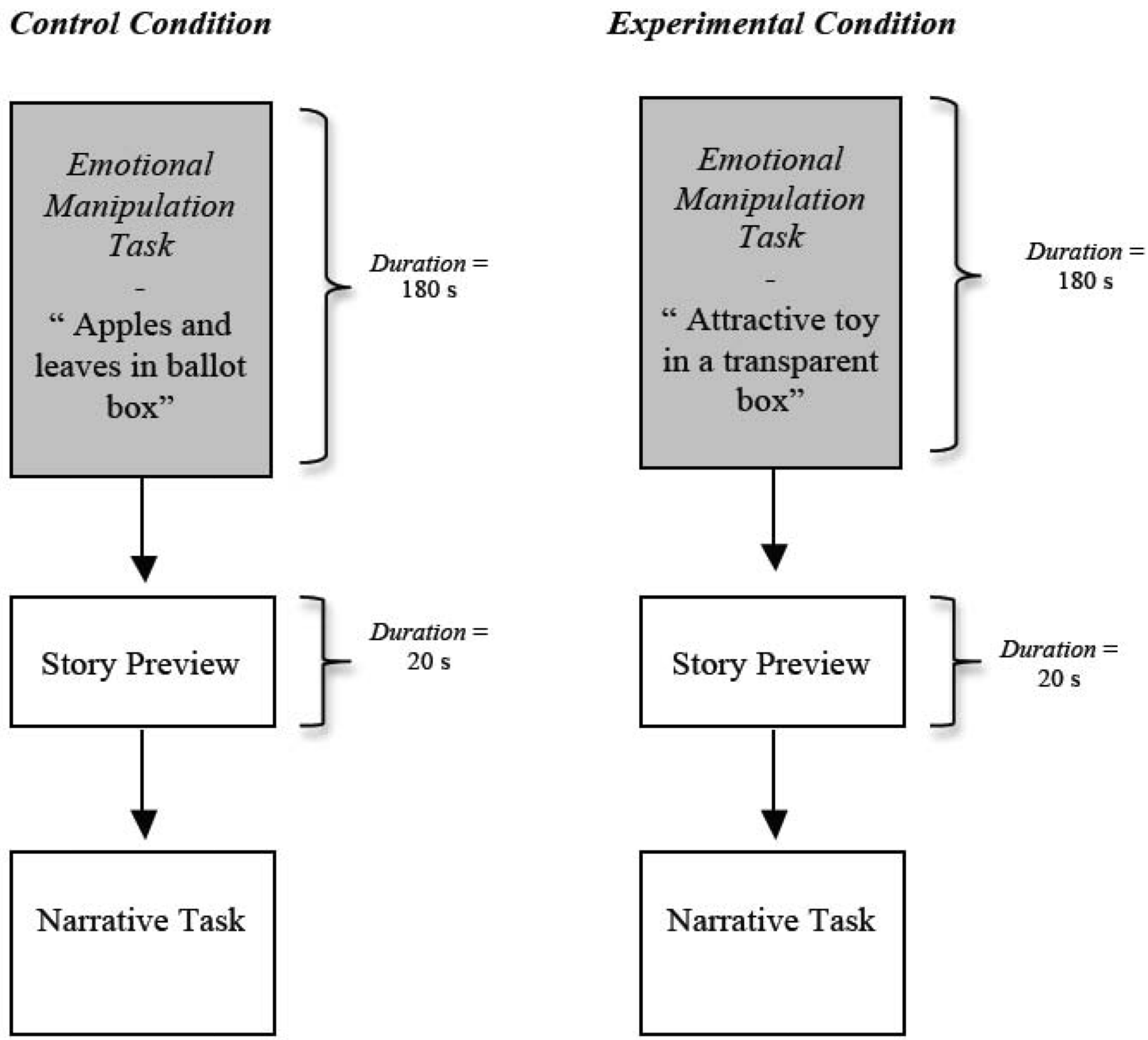


**Figure 1.**

Sequence of tasks (i.e., emotional manipulation, preview of the story pictures, and narrative) during the control and the experimental conditions.

**Table 1**

Estimated marginal means and standard errors for emotional reactivity, emotion regulation, and disfluency measures for children who stutter (CWS) and children who do not stutter (CWNS) during the control and the experimental conditions.

| Dependent Measures | Control Condition | | Experimental Condition | |
|---|---|---|---|---|
| | CWS | CWNS | CWS | CWNS |
| | Mean (Std.Error) | Mean (Std.Error) | Mean (Std.Error) | Mean (Std.Error) |
| ***Emotional Reactivity*** | | | | |
| **Negative Affect** | 6.12 (1.14) | 3.06 (0.59) | 18.26 (3.41) | 7.89 (1.53) |
| **Positive Affect** | 2.76 (0.57) | 2.7 (0.58) | 2.16 (0.45) | 2.5 (0.54) |
| ***Emotion Regulation*** | | | | |
| **Self-Speech** | 3.64 (0.9) | 1.25 (0.32) | 6.94 (1.7) | 5.85 (1.49) |
| **Distraction** | 7.72 (2.67) | 6.22 (2.21) | 15.7 (5.36) | 9.18 (3.25) |
| ***Disfluencies*** | | | | |
| **Stuttered disfluencies** | 10.82 (1.73) | 1.65 (0.26) | 11.16 (1.79) | 1.79 (0.27) |
| **Non-stuttered disfluencies** | 6.1 (0.92) | 7.44 (0.94) | 7.05 (0.93) | 6.78 (0.94) |